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Red pine, white pine, white spruce stock type comparisons

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Over the years, numerous studies have been conducted which compare the field performance of seedlings to that of transplants (Glerum and Paterson 1985; Racey and Hutchison 1984; Racey *et. al.* 1983; Mullin 1980a; Mullin 1980b; Mullin and Howard 1973). As nursery cultural practices change it is important to continue to document the potential field performance of our major coniferous species so that "bench-mark" standards (Mullin 1978 a,b,c,d; Mullin 1979) can be established and used by field personnel to judge the relative performance of operational field plantings.

This report compares the field performance of several red pine (*Pinus resinosa Ait.*), white pine (*P. strobus L.*) and white spruce (*Picea glauca (Moench) Voss)* stock types after seven growing seasons.

Procedure

All nursery stock used in this study originated from the Midhurst Forest Tree Nursery and represents all the stock types being grown in 1982. The stock types by species used were:

Red pine 1+1, 2+0, 1+2 and 3+0.
White pine 1+1, 2+0, 1+2, 2+1, 3+0 and 2+2.
White spruce 2+0, 1½+½, 1½+1½ and 3+0.

Trees were hand-lifted using a shovel and packaged on site in a multi-walled poly-lined Kraft bag. The nursery stock was not root pruned during lifting or prior to planting, and was planted by hand using a modified wedge method. Transportation and field planting were completed within one hour after lifting.

The soil at the planting site consisted of 0.6 metres of loam over clay loam with a fresh moisture regime. The site was cultivated the year prior to planting and cultivated between and around the trees for two years after planting to exclude all herbaceous competition, thus allowing optimum conditions for establishment.

Three lift dates, April 30, May 7 and May 14, were used for each species in an attempt to span the nurseries operational lifting season. On each lift date 25 trees per stock type per species were planted with each lift date representing one replication for each stock type planted. New root growth and bud activity for each stock type was recorded at each lift date.

Total height, diameter at breast height (Dbh) and survival were assessed seven years after planting. The data were analyzed using an analysis of variance for a completely randomized design and means separation tests using Duncans multiple range test ($p=0.05$).

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Results and Discussion

At time of planting air temperatures were around 18° C, soil temperatures ranged from 10° C (April 30) to 15° C (May 7 and 14) while relative humidity fluctuated between 40 and 60 percent.

On the first lift (April 30) all species had some active root tips, however, terminal buds were not showing any visible signs of activity. By the second lift (May 7) all the roots had become active and terminal buds were either elongating (red pine, white pine) or partially flushing (white spruce). At the time of the third plant (May 14) roots in all species were elongating and terminal buds, in the pine species, had elongated to 3-4 cm while all buds in white spruce had flushed. Differences in root and bud activity between stock types within a species were not apparent.

Red Pine

No significant differences in survival between stock types were found. Overall survival after seven years was 91.3 % with survivals by stock type ranging from 88.0 (3+0) to 94.7 (2+0).

The 1+2 stock had the greatest mean total height (3.0 metres) after seven years of field growth (Fig. 1). Comparing the mean total heights of the other stock types to the 1+2 stock, the mean total height of the 3+0 is 11 %, 2+0 is 12 % and 1+1 is 18 % less than the height achieved by the 1+2 stock (Fig. 1).

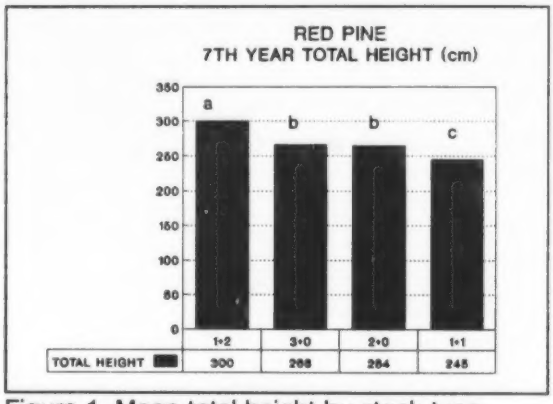

Figure 1. Mean total height by stock type.

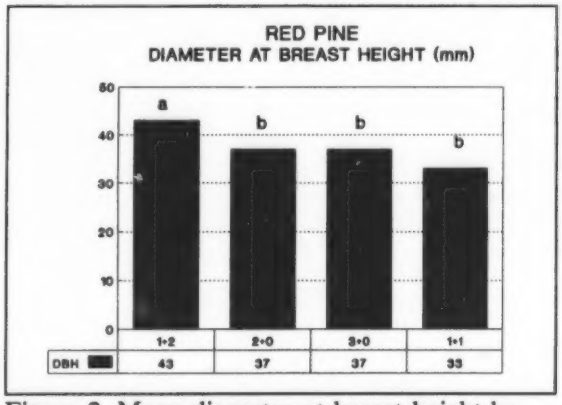

Figure 2. Mean diameter at breast height by stock type.

The 1+2 stock also had the greatest diameter (4.3 cm) at breast height (Dbh) after seven years, with the 2+0, 3+0 and 1+1 stocks Dbh reduced by 14, 14 and 23 % respectively (Fig. 2).

Comparing the three lifting dates, all stock types combined, no significant difference in total heights or diameters and for individual stock types no pattern of growth in relation to lifting dates could be established. Being close to the nursery, with the planting site well prepared and working with well supervised experienced planters, the stress factors caused by handling and planting, which normally would reduce the trees performance after planting was clearly minimized (Pierpoint et al. 1981).

White Pine

No significant differences in survival between stock types were found. Overall survival after seven years was 95.1 % with survivals by stock type ranging from 92.0 (2+1) to 97.3 (2+0).

The 2+2 stock had the greatest total height (3.05 metres) after seven years. The five other stock types expressed as a percent of the 2+2 stock had reduced heights as follows: 1+2, 4 %; 3+0, 11 %; 2+1, 12 %; 2+0, 13 %; and 1+1, 19 % (Fig. 3). The 2+2 stock also had the greatest Dbh

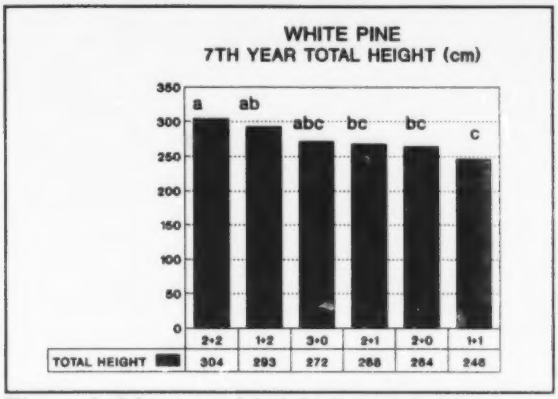

Figure 3. Mean total height by stock type.

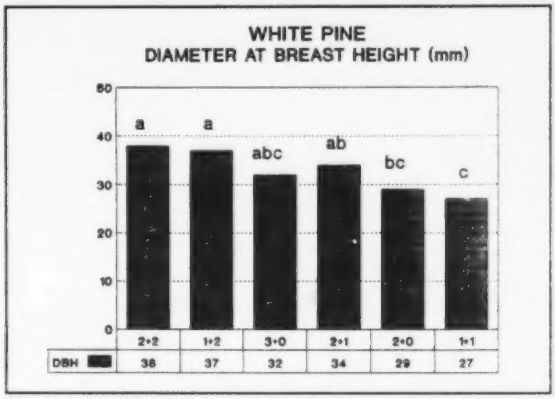

Figure 4. Mean diameter at breast height by stock type.

(3.8cm) with a greater difference, in percent reductions between stock types, than that observed for total heights. The reductions in percent Dbh are as follows: 1+2, 3 %; 2+1, 10 %; 3+0, 16 %; 2+0, 24 %; and 1+1, 29 % (Fig. 3). The 3+0 stock, although slightly taller than the 2+1 stock, has 4 % less diameter growth after seven years (Fig. 4).

The differences in performance at seven years between the best (2+2) and poorest (1+1) stock types is 0.5 metres in total height and 1.1 cm in Dbh, with only a 1.3 % difference in survival. Obviously survival is not the best indicator of stock performance, however, mean height and Dbh were sensitive indicators of differences in the rate of establishment between stock types, with Dbh showing the largest differences. As in the red pine, the white pine performance related to lift dates was non-significant.

White Spruce

No significant differences in survival between stock types were found. Overall survival after seven years was 97.0 % with survivals by stock type ranging from 96.0 (3+0) to 97.3 (2+0).

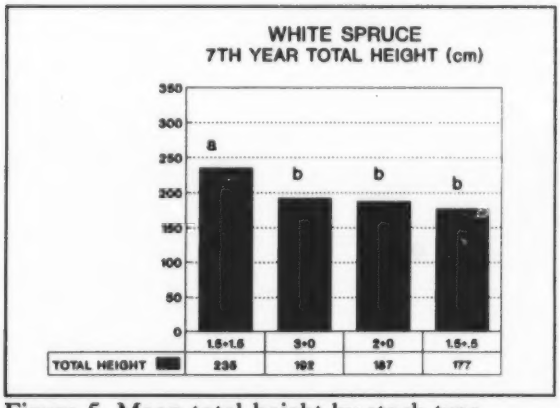

Figure 5. Mean total height by stock type.

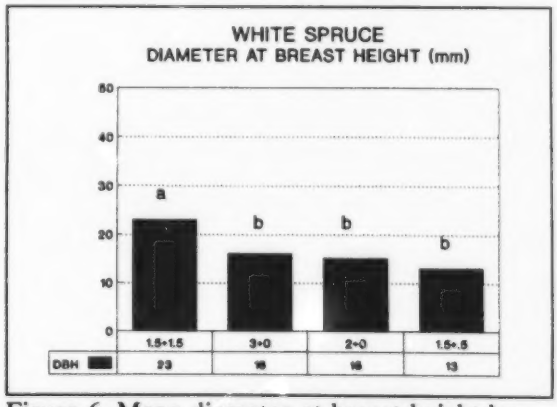

Figure 6. Mean diameter at breast height by stock type.

The 1½+1½ stock had the greatest mean height (2.34 metres) with the percent reduction in total height by stock type of 18 % for 3+0, 20 % for 2+0, and 25 % for 1½+½ (Fig. 5).

The 1½+1½ stock also had the greatest diameter, and the other stock types remained in the same order as that for mean heights. The percent reduction in diameter however, was much more than that for mean heights and was as follows: 3+0, 30 %; 2+0, 35 %; and 1½+½, 43 % (Fig. 6).

Although there was no significant difference in survival after seven years between the best (1½+1½) and poorest (1½+½) stock, there was a 57 cm difference in total height and a 1 cm difference in Dbh. Lifting date had no significant effect on the survival or growth of white spruce.

Conclusions

The results of this study indicate that for all stock types within the three species tested, acceptable survival was achieved when stock was handled and planted under well controlled conditions. In contrast, seven-year performance measured in terms of total height and diameter at breast height, dependent on the stock type and indicates that not all transplants outperform seedling stock.

If carried through to rotation age, the reductions in total height and Dbh observed for some stock types in this study, would result in less volume being produced in a given time period or an extended rotation would be required to achieve acceptable volumes for the poorer performers. Thus, the eventual productivity of plantations at the end of a rotation depend on the stock choices made at the time of planting. Through continuing programs of field testing nursery stock we can ensure that the best stock, suited to the regeneration job at hand, will be produced.

The nursery cultural practices and costs required to produce the various stock types within the species tested differ and can dramatically alter the field performance of the stock. By continually testing the currently produced stock types, stock exhibiting changes in field performance resulting from new cultural treatments could be identified; resulting in the removal of poor-performers from the production cycle.

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